MakevaleGroup

Transforming manufacturing: process innovations in polymer science

WHITEPAPER

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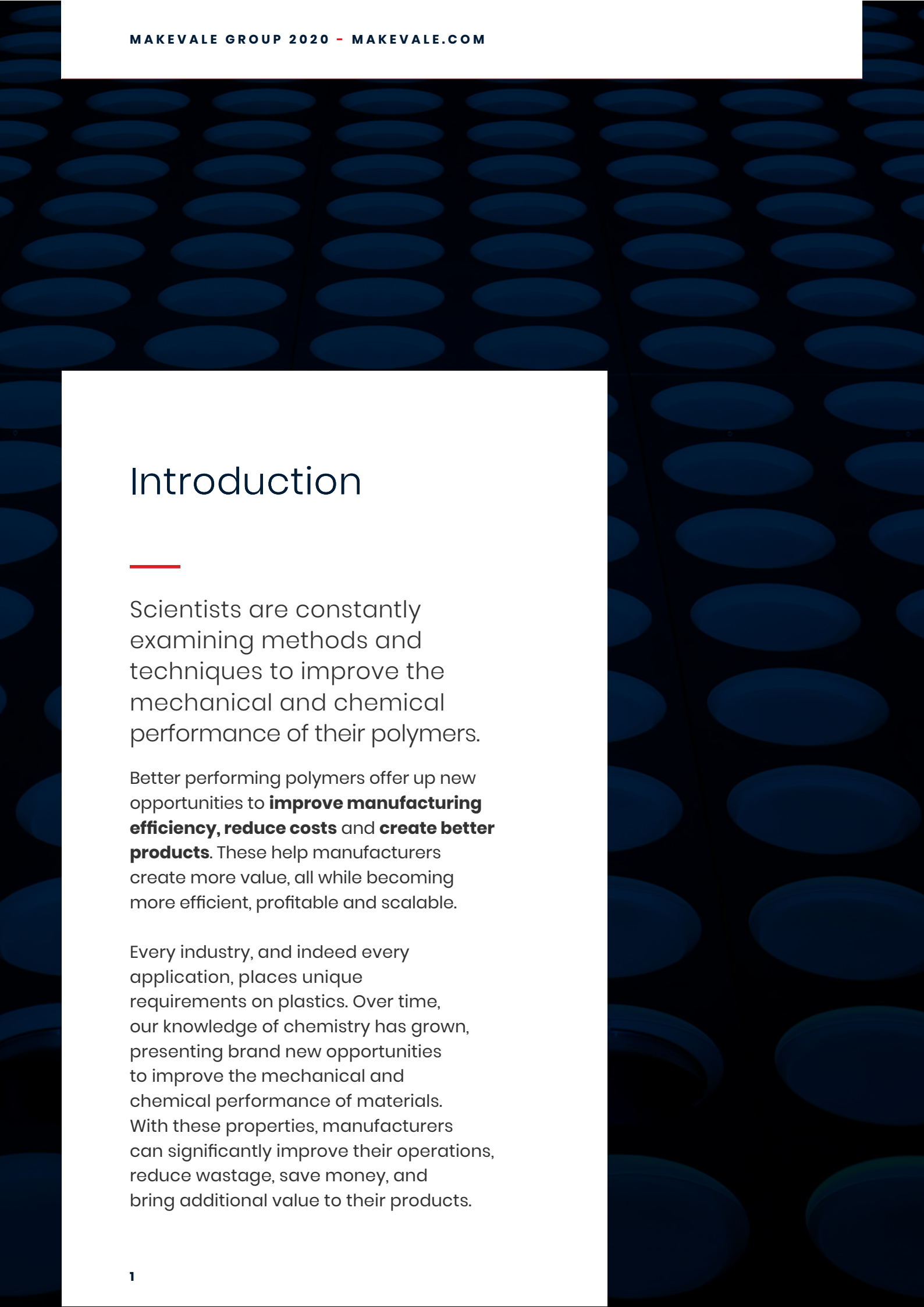

Introduction

Scientists are constantly examining methods and techniques to improve the mechanical and chemical performance of their polymers.

Better performing polymers offer up new opportunities to **improve manufacturing efficiency, reduce costs** and **create better products**. These help manufacturers create more value, all while becoming more efficient, profitable and scalable.

Every industry, and indeed every application, places unique requirements on plastics. Over time, our knowledge of chemistry has grown, presenting brand new opportunities to improve the mechanical and chemical performance of materials. With these properties, manufacturers can significantly improve their operations, reduce wastage, save money, and bring additional value to their products.

Introducing new qualities into polymers

Great products are created with great materials.

The difficulty is that the chemical qualities and mechanical properties differ for each product, market and application; a high performance polymer for one industry won't translate its benefits fully into another.

Scientific research has shown that some chemistries and post-production treatments influence chemical and mechanical makeup of polymers in unique ways. With a knowledge of these methods growing, experienced chemists will be able to learn and use techniques created to achieve certain characteristics, and adjust these to work for another application.

There are many techniques available that modify surface characteristics. Surface preparation methods and treatment processes are critical for achieving specific characteristics. For example, Makevale's chemists were able to use their knowledge of pigmentation used in dental polymers and translate this into the cosmetic nail industry.

Chemistry innovations in coloured acrylics

Coloured acrylics are one application requiring a unique chemistry and post-processing. After manufacture, polymers are first subjected to a multi-step process that is used to yield clean beads with a sticky surface that has a strong affinity to pigments. This results in a strong polymer-pigment bond, with a homogeneous pigment dispersion that suppresses the tendency for pigment agglomeration.

Other processes can then be applied to suppress yellowing and blanching while enhancing flow for further processing. These techniques have been developed over a 40 year period for the dental industry, with Makevale now being recognised as a leading dental colouring expert. The same technology concepts have been applied to other industries such as the cosmetic nail industry.

Tight control for manufacturing efficiency and consistency

Manufacturing efficiency is underpinned by a consistent supply of high quality materials.

When it comes to bead polymers, small variations in bead size, morphology and shape can change the handling properties of the material.

Maintaining this precision at scale is imperative to reduce waste and speed up manufacturing time – both of which save manufacturers money.

> *"We offer unprecedented control over the resulting polymers."*

Within the confines of a laboratory, tightly controlling processes can be quite straightforward. Replicating this at an industrial scale is a different matter, however. Makevale can fine tune bead size, morphology and shape at scale to provide unique properties.

Maintaining a tight control over fluid mechanics and kinetics throughout polymerisation is crucial. Without specialised equipment, achieving consistent, high-quality material from every batch can be incredibly difficult.

Due to the nature of Makevale's research and development projects, the company possesses a number of custom-made equipment that offers unprecedented control over the resulting polymers. This bespoke equipment enables polymerisation and post-processing at unparalleled precision.

Tighter specifications are becoming increasingly common, particularly in the aerospace and orthopaedic markets. Makevale offers one of the most competitive offerings in terms of consistency, which comes from a combination of chemistry and engineering.

A selection of our quality assurance & testing equipment;

- **FTIR (Fourier Transform Infrared Spectroscopy) – composition information**
- **GPC (Gel Permeation Chromatography) – molecular weight**
- **UV-Vis (Ultraviolet–visible spectroscopy) – colour**
- **Power Compensated DSC (Differential scanning calorimetry) – Glass transition temperature**
- **Control Stress Rheometer – viscosity of solutions/suspensions etc.**
- **Brookfield viscometer - viscosity of solutions/suspensions etc.**
- **U-tube viscometers – Molecular weight**
- **Laser diffraction particle size analyser 10nm-3.5mm range**
- **Volatiles analyser – purity**
- **GC-FID- (Gas chromatography-flame ionisation) – composition /purity**
- **Refractometer – refractive index of liquids**
- **Zwick Z010 Mechanical Testing instrument**
- **Spectrofluorometer – research tool**
- **Digital microscope with metrological and EDF capabilities – measuring dimensions on the microscale**

MakevaleGroup

Learn about Makevale's materials

Headquartered in the United Kingdom, our leadership team works with Makevale facilities positioned all over the world. But that's not what makes our international presence special. Our facilities are all equipped to manufacture materials for our customers internationally, making us resilient to the ever-changing landscape.

We're continuing to invest millions (£) in new world-class technology and manufacturing equipment. In 2020, we've built a new large-scale reactor park, enabling us to bring laboratory-scale precision to industry.

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